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NEW ELECTRONIC VOLTAGE RELAYS

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[A Digest]

There are many applications for three-position AC voltage relays in voltage regulation under load conditions using transformers or auto-transformers. Relays of this type (EN-146) have been manufactured in the past by the Kharkov Electro-Mechanical Factory. They operate on a voltage variation of $\pm 1.5 - 2.0$ percent, closing one set of contacts when the voltage rises, and another set when it falls.

The present article describes two electronic voltage relays developed in VEI (All-Union Electrical Engineering Institute) by G. R. Gertsenberg, Candidate in Technical Sciences. One is a two-position relay, the other, a three-position relay. Both use a 4TslM diode as the relay measuring element. The 4TslM is a high-stability diode with a filament voltage of 4 volts, a filament current of 1.6 - 1.9 amperes, and a plate current of 10 milliamperes.

Two-Position Electronic Voltage Relay

The author first points out the difficulties encountered in designing AC voltage relays with a high coefficient of return, which is frequently needed for automatic control or protective circuits. This coefficient is usually 0.5 - 0.6 for load-switching purposes, while special electromagnetic protective relays have a coefficient of 0.85. Attempts to increase this value requires a reduction in pressure on the contacts, which lowers their operating reliability. These problems, however, can be overcome by employing an electronic relay, such as is shown in Figure 1, appended.

The coefficient of return is nearly unity, due to considerable current variation in the relay coil for small changes in voltage at the relay terminals.

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The coefficient may be adjusted with potentiometer R₅. The use of a 4Ts1M diode ensures considerable stability. The relay consumes 0.1 amperes for an operating and cut-in voltage of 220 volts, and can be kept energized continuously at normal voltages. Its setting may be altered with rheostat R₁.

Due to thermal inertia of the 4Ts1M filament, the relay has some lag, depending on the magnitude of the relative change in voltage with respect to the set voltage. For a voltage variation of 95 - 105 percent of the setting, the lag is 0.1 seconds.

Three-Position Electronic Voltage Relay

The principle of operation for this relay is the same as that for the previously described one. The circuit parameters were chosen so that the relay characteristics would correspond to the conditions for voltage regulation of a transformer in voltage steps of 2.5 percent. For transformers or auto-transformers with smooth regulation, the relay permits variations in the setting within the limits ± 1 percent. When the voltage falls to 60 percent of the set value, both sets of relay contacts are broken. The nonactuating zone for the relay may be changed by potentiometer R₅ which, as before, is connected to the grid of the second half of double triode L₂. This adjustment is sometimes necessary during voltage regulation of auto-transformers with smooth regulation (Variac, etc.). The operating voltage can be varied in the limits ± 10 percent with rheostat R₁. Time lag is 0.1 - 0.15 seconds for voltage change from 90 to 110 percent of set value.

The apparatus consumes 30 volt-amperes AC. The 4Ts1M tube is operated at low-filament voltage which ensures a long period of service (10,000 hours).

The designs for both relays were worked out under the leadership of Comrade Verelov at the "Energoremtrest" Plant of the Ministry of Electric Industry, where it is now being serially produced.

[Appended figure follows]

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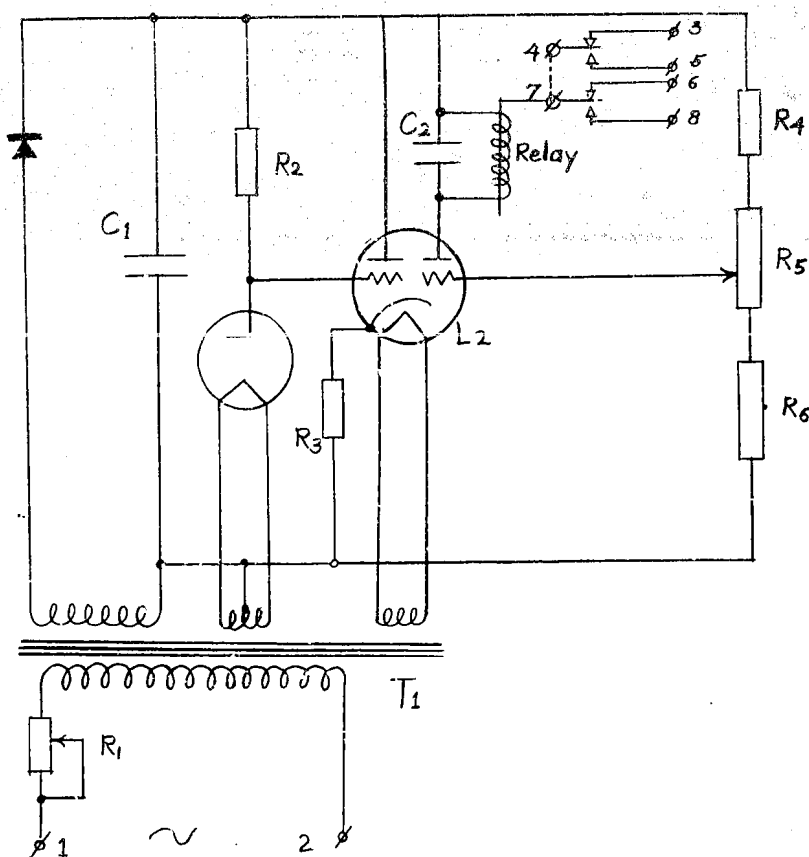


Figure 1. Two-Position Electronic Relay

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